

## COMPARISON OF ANTIMICROBIAL ALTERNATIVES IN DIETS FOR NURSERY PIGS

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### Summary

A total of 720 weanling pigs (12.8 lb and  $18 \pm 2$  d of age, PIC) was used in two trials to determine the effectiveness of antimicrobial alternatives in diets for nursery pigs. Pigs were fed one of 8 experimental diets: 1) Control with no antibiotics or antimicrobial alternatives, 2) carbadox (50 g/ton), 3) Probios® (1.6% from d 0 to 14 and 0.8% from d 14 to 21), 4) BioSaf® (0.3%), 5) Biomate Yeast Plus® (0.1%), 6) Bio-Mos™ (0.3%), 7) Bio-Plus® 2B (0.05%), or 8) LactoSacc® (0.2%). BioSaf®, Biomate® Yeast Plus®, and Lacto Sacc® are all concentrated forms of selected live yeast cells, while Bio-Mos™ is a mannanoligosaccharide derived from yeast. Probios® is a form of lactic acid bacteria and Bio Plus® 2B contains two bacillus strains.

Overall (d 0 to 27), pigs fed the diet containing carbadox had greater ( $P < 0.05$ ) ADG compared to pigs fed all other diets. Pigs fed the diet containing carbadox also had greater ( $P < 0.05$ ) ADFI compared to pigs fed BioSaf, Yeast Plus, Bio Mos, Bio Plus 2B and Lacto Sacc. Pigs fed the diet containing Bio Plus 2B had lower ( $P < 0.05$ ) ADFI compared to pigs fed the diet containing Probios. Pigs fed the diet containing Probios had the poorest ( $P < 0.05$ ) F/G compared pigs fed all other diets except the control diet. In addition, pigs fed

the diet containing carbadox had improved ( $P < 0.05$ ) F/G compared to pigs fed the control diet or the diet containing Probios. In conclusion, the addition of carbadox – but not antimicrobial alternatives – in nursery pig diets resulted in a consistent improvement in growth performance over pigs fed the control diet. Although pigs fed antibiotic alternatives showed no improvement over carbadox, a numeric improvement in F/G for some products over pigs fed the control diet warrants further investigation.

(Key Words: Nursery Pig, Carbadox, Feed Additive)

### Introduction

Antibiotics have been widely used within the swine industry to improve herd health and promote growth. However, due to recent concerns with the use of feed grade antibiotics in animal agriculture, antimicrobial alternatives are being further explored. Results of studies with pigs fed diets containing supplemental yeast, direct-fed microbials, and mannanoligosaccharides have been conflicting with some trials showing no improvement, whereas others show benefits in growth performance. Previous research at Kansas State University has evaluated the use of such products in bacteria reduced or irradiated diets. This experiment was designed to complement previous

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trials with the objective of evaluating several classes of antimicrobial alternatives on growth performance of nursery pigs within the same study.

### Procedures

A total of 720 weanling pigs (12.8 lb and  $17 \pm 2$  d of age, PIC) was blocked by weight and allotted to one of eight dietary treatments. The study was divided into two trials, the first beginning in September 2002, and the second starting in January 2003. The results were combined for statistical analysis for a total of 18 replications. The trials were conducted at the Kansas State University Segregated Early Weaning Facility. In each trial, there were five pigs per pen and nine pens per treatment. Each pen was 4 x 4 ft and contained one self-feeder and one nipple waterer to provide ad libitum access to feed and water.

All pigs were fed treatment diets from weaning to d 27 post-weaning. There were eight experimental diets with a control diet with no antimicrobials, or the control diet with added: carbadox (50 g/ton), Probios<sup>®</sup> (1.6% from d 0 to 14 and 0.8% from d 14 to 21), BioSaf<sup>®</sup> (0.3%), Biomate Yeast Plus<sup>®</sup> (0.1%), Bio-Mos<sup>™</sup> (0.3%), Bio-Plus<sup>®</sup> 2B (0.05%), or LactoSacc<sup>®</sup> (0.2%). BioSaf<sup>®</sup>, Biomate Yeast Plus<sup>®</sup>, and Lacto Sacc<sup>®</sup> are all concentrated forms of selected live yeast cells, while Bio-Mos<sup>™</sup> is a mannanoligosaccharide derived from yeast. Probios<sup>®</sup> is a form of lactic acid bacteria and Bio Plus<sup>®</sup> 2B contains two bacillus strains. All products were added at the manufacturers' recommended inclusion rates. Dietary treatments were fed in meal form. Phase one diets (d 0 to 14 post-weaning) were formulated to contain 1.50% lysine, 0.90% Ca, and 0.54% available phosphorus. Phase two diets (d 14 to 27) were formulated to contain 1.45% lysine, 0.85% Ca, and 0.44% available phosphorus. In addition, diets did not contain growth-promoting levels of copper or zinc. Average daily gain (ADG), average

daily feed intake (ADFI), and feed efficiency (F/G) were determined by weighing pigs and measuring feed disappearance on d 7, 14, 21, and 27 post weaning.

Data were analyzed as a randomized complete block design with pen as the experimental unit. Pigs were blocked based on weaning weight, and analysis of variance was performed using the Mixed procedure of SAS.

### Results and Discussion

From d 0 to 14, pigs fed the diet containing carbadox had greater ( $P<0.05$ ) ADG compared to pigs fed all other diets. Pigs fed the diet containing carbadox had improved ( $P<0.05$ ) F/G compared to pigs fed the control diet or diets containing Probios or Bio-Mos. Also, pigs fed diets containing BioSaf, Yeast Plus, Bio-Plus 2B or Lacto Sacc had improved ( $P<0.05$ ) F/G compared to pigs fed Probios.

From d 14 to 27, pigs fed the diets containing carbadox or Probios had greater ( $P<0.05$ ) daily feed intake compared to pigs fed all other diets. Pigs fed the diet containing Bio Mos had improved ( $P<0.05$ ) F/G compared to pigs fed the control diet with no antimicrobials or pigs fed the diet containing Probios. In addition, pigs fed diets containing carbadox, Yeast Plus, Bio Plus 2B or Lacto Sacc had improved ( $P<0.05$ ) F/G compared to pigs fed the diet containing Probios.

Overall (d 0 to 27), pigs fed the diet containing carbadox had greater ( $P<0.05$ ) ADG compared to pigs fed all other diets. Pigs fed the diet containing carbadox also had greater ( $P<0.05$ ) ADFI compared to pigs fed diets containing BioSaf, Yeast Plus, Bio Mos, Bio Plus 2B or Lacto Sacc. Pigs fed the diet containing Probios had greater ( $P<0.05$ ) ADFI than pigs fed the diet containing Bio-Plus 2B. Pigs fed the diet containing carbadox had improved ( $P<0.05$ ) F/G compared to pigs fed the control diet or the diet containing Probios. In addition, pigs fed diets containing BioSaf,

Yeast Plus, Bio-Mos, Bio-Plus 2B or Lacto Sacc had improved ( $P<0.05$ ) F/G compared pigs fed the diet containing Probios.

In conclusion, the addition of antimicrobial alternatives in nursery pig diets did not result in a consistent improvement in growth performance over pigs fed the control diet. However, pigs fed the diet containing carba-

dox had improved ( $P<0.05$ ) ADG (10%) and F/G and tended to have numerically greater ADFI (6%) compared to pigs fed the control diet. Although pigs fed antibiotic alternatives showed no improvement over carbadox, numeric improvement in F/G for some products over pigs fed the control diet warrants further investigation.

**Table 1. Diet Composition (As-fed Basis)**

Item, %	Phase I <sup>a</sup>	Phase II <sup>b</sup>
Corn	49.11	52.61
Soybean meal, 46.5% CP	25.74	33.36
Spray dried whey	15.00	7.50
Spray-dried animal plasma	5.00	-
Select menhaden fish meal	-	2.50
Monocalcium phosphate, 21% P	1.40	1.15
Limestone	1.10	0.85
Salt	0.40	0.40
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
Lysine HCl	0.15	0.15
DL-Methionine	0.10	0.08
Corn starch or test ingredient <sup>c</sup>	1.60	1.00
Total	100.00	100.00
<u>Calculated Analysis</u>		
Lysine, %	1.50	1.45
Isoleucine:lysine ratio, %	60	66
Leucine:lysine ratio, %	131	134
Methionine:lysine ratio, %	28	31
Met & Cys:lysine ratio, %	58	57
Threonine:lysine ratio, %	64	61
Tryptophan:lysine ratio, %	19	19
Valine:lysine ratio, %	74	75
ME, kcal/lb	1,491	1,493
CP, %	21.90	22.50
Ca, %	0.90	0.85
P, %	0.80	0.75
Available P, %	0.54	0.44
Lysine:calorie ratio, g/mcal	4.56	4.41

<sup>a</sup>Diets fed from d 0 to 14.

<sup>b</sup>Diets fed from d 14 to 27.

<sup>c</sup>Test ingredients replaced cornstarch.

**Table 2. The Effects of Antimicrobial Alternatives on Nursery Pig Performance<sup>a</sup>**

	Feed Additives <sup>b</sup>								SE	TRT <sup>c</sup>
	Control	Carbadox	Probios	BioSaf	Yeast Plus	Bio-Mos	Bio-Plus 2B	LactoSacc		
D 0 to 14 <sup>d</sup>										
ADG, lb	0.38 <sup>e</sup>	0.44 <sup>f</sup>	0.35 <sup>e</sup>	0.38 <sup>e</sup>	0.38 <sup>e</sup>	0.38 <sup>e</sup>	0.39 <sup>e</sup>	0.38 <sup>e</sup>	0.021	0.018
ADFI, lb	0.47	0.49	0.46	0.46	0.46	0.46	0.46	0.45	0.021	0.782
F/G	1.26 <sup>ef</sup>	1.14 <sup>g</sup>	1.32 <sup>e</sup>	1.23 <sup>fg</sup>	1.23 <sup>fg</sup>	1.26 <sup>ef</sup>	1.20 <sup>fg</sup>	1.21 <sup>fg</sup>	0.044	0.005
D 14 to 27 <sup>h</sup>										
ADG, lb	1.02	1.11	1.07	1.03	1.04	1.05	1.01	1.06	0.035	0.114
ADFI, lb	1.34 <sup>e</sup>	1.43 <sup>f</sup>	1.43 <sup>f</sup>	1.33 <sup>e</sup>	1.34 <sup>e</sup>	1.31 <sup>e</sup>	1.30 <sup>e</sup>	1.34 <sup>e</sup>	0.039	0.005
F/G	1.31 <sup>ef</sup>	1.28 <sup>fg</sup>	1.34 <sup>e</sup>	1.30 <sup>efg</sup>	1.29 <sup>fg</sup>	1.26 <sup>g</sup>	1.29 <sup>fg</sup>	1.27 <sup>fg</sup>	0.023	0.032
D 0 to 27										
ADG, lb	0.69 <sup>e</sup>	0.76 <sup>f</sup>	0.70 <sup>e</sup>	0.69 <sup>e</sup>	0.70 <sup>e</sup>	0.70 <sup>e</sup>	0.69 <sup>e</sup>	0.70 <sup>e</sup>	0.024	0.050
ADFI, lb	0.89 <sup>efg</sup>	0.94 <sup>g</sup>	0.93 <sup>fg</sup>	0.88 <sup>ef</sup>	0.89 <sup>ef</sup>	0.87 <sup>ef</sup>	0.86 <sup>e</sup>	0.88 <sup>ef</sup>	0.027	0.045
F/G	1.29 <sup>ef</sup>	1.24 <sup>g</sup>	1.33 <sup>e</sup>	1.27 <sup>fg</sup>	1.27 <sup>fg</sup>	1.25 <sup>fg</sup>	1.26 <sup>fg</sup>	1.25 <sup>fg</sup>	0.021	0.001

<sup>a</sup>A total of 720 pigs initially 12.8 lb and 18 ± 2 d of age with five pigs per pen and 18 replicates per treatment .

<sup>b</sup>Inclusion rates are as follows; carbadox (50 g/ton), Probios<sup>®</sup> (1.6% from d 0 to 14 and 0.8% from d 14 to 21), BioSaf<sup>®</sup> (0.3%), Bio-mate Yeast Plus<sup>®</sup> (0.1%), Bio-Mos<sup>™</sup>(0.3%), Bio-Plus<sup>®</sup> 2B (0.05%), or LactoSacc<sup>®</sup> (0.2%).

<sup>c</sup>P-value represents overall treatment effect.

<sup>d</sup>Phase one diets fed from d 0 to 14 and formulated to contain 1.50% lysine, 0.90% Ca, and 0.54% available P.

<sup>efg</sup>Means in the same row with different superscripts differ (P<0.05).

<sup>h</sup>Phase two diets fed from d 14 to 27 and formulated to contain 1.45% lysine, 0.85% Ca, and 0.44% available P.